

CLAIMS

1. A method of analyzing sequences of atomic groups including a first sequence having m atomic groups and a second sequence having n atomic groups where m and n are integers, comprising the steps of:
- 5 a) preparing an array S[i] having array elements S[0] to S[m];
- b) initializing all array elements of the array S[i] to zero and initializing an integer j to 1;
- 10 c) adding 1 to each array element S[i] that is equal to an array element S[r] and that  $i \geq r$  if the array element S[r] is equal to an array element S[r-1] where r is an occurrence position of j-th atomic group of the second sequence in the first sequence;
- 15 d) adding 1 to the integer j;
- e) repeating the step c) and d) until the integer j exceeds n; and
- f) obtaining a longest common atomic group number between the first and the second sequences from a value of the array element S[m].
- 20 2. A method of claim 1, further comprising the steps of:
- g) preparing an array data[k] having array elements data[0], data[1] ...;
- 25 h) storing paired data (r, j) in an array element data[k] if the array element S[i] is changed in the step c) where  $k = S[r]$ ;
- i) linking the paired data (r, j) stored in the step h) to paired data (r', j') if  $r' < r$  and  $j' < j$  where the paired data (r', j') is one stored in an array element data[k-1]; and
- 30 j) obtaining a longest common subsequence between the first and the second sequences and occurrence positions of the longest common subsequence
- 35 in the first and the second sequence by tracing the link formed in the step i).

5 k) evaluating homology between the first and the second sequences based on the longest common atomic group number and a value of one of m and n.

10                    1)    searching for a sequence that is homologous with the first sequence from among a plurality of sequences, by successively assigning one of the plurality of sequences to the second sequence and executing the steps a) to f) and k).

20 a) generating a combination of  
correspondence satisfying a restriction condition  
between the elements belonging to the first point set  
and the elements belonging to the second point set  
from among all candidates for the combination of  
correspondence; and

6. A method of claim 5, wherein the restriction condition includes order relation of the elements in the first and the second point sets that are ordered.

35            8.    A method of claim 6 wherein the restriction condition includes proximity in a geometric relationship among a plurality of elements close to

each other.

5 9. A method of claim 5, wherein the restriction condition includes a condition such that a candidate for the combination of correspondence satisfies a threshold value condition.

10 10. A method of claim 6, wherein the restriction condition includes a condition such that a candidate for the combination of correspondence satisfies a threshold value condition.

10 11. A method of claim 5, wherein the restriction condition includes a condition such that an attribute value of each of the elements belonging to the first point set coincides with an attribute value of the corresponding element belonging to the second point set in a candidate for the combination of  
15 correspondence.

20 12. A method of claim 6, wherein the restriction condition includes a condition such that an attribute value of each of the elements belonging to the first point set coincides with an attribute value of the corresponding element belonging to the second point set in a candidate for combination of correspondence.

25 13. A method of analyzing three-dimensional structures including a first structure expressed by three-dimensional coordinates of elements belonging to a first point set and a second structure expressed by three-dimensional coordinates of elements belonging to a second point set, comprising the steps of:

30 a) dividing the second point set into a plurality of subsets having a size that is determined by the size of the first point set;

35 b) generating a combination of correspondence satisfying a restriction condition between the elements belonging to the first point set and the elements belonging to each of the subsets of the second point set from among all candidates for the combination of correspondence; and

c) calculating a root mean square distance between the elements corresponding in the combination of correspondence generated in the step b).

5 14. A method of claim 13, wherein the second point set is divided into the subsets so that the number of elements belonging to each of the subsets is a function of the number of elements belonging to the first point set.

10 15. A method of claim 13, wherein the second point set is divided into the subsets so that a spatial size of each of the subsets is nearly equal to a spatial size of the first point set.

15 16. A method of analyzing three-dimensional structures including a first structure expressed by three-dimensional coordinates of elements belonging to a first point set and a second structure expressed by three-dimensional coordinates of elements belonging to a second point set, comprising the steps of:

20 a) dividing the first point set and second point set into first subsets and second subsets, respectively, according to a secondary structure exhibited by the three-dimensional coordinates of the elements of the first and the second point sets;

25 b) generating a combination of correspondence satisfying a first restriction condition between the first subsets and the second subsets from among candidates for the combination of correspondence;

30 c) determining an optimum correspondence between the elements belonging to each pair of subsets corresponding in the combination of correspondence generated in the step b), and )

35 d) calculating a root mean square distance between all of the elements corresponding in the optimum correspondence in the step c).

17. A method of claim 16, wherein the optimum correspondence determining step comprising the

substeps of:

- 5           i)    generating a combination of  
correspondence satisfying a second restriction  
condition between the elements belonging to the  
subsets corresponding in the combination of the  
correspondence generated in the step b);
- ii)   calculating a root mean square distance  
between the elements corresponding in the combination  
of the correspondence generated in the substep i);
- 10          iii)   selecting a combination of the  
correspondence as the optimum correspondence according  
to the value of the root mean square distance value  
calculated in the substep ii).

15       18.   An apparatus for analyzing sequences of  
atomic groups including a first sequence having m  
atomic groups and a second sequence having n atomic  
groups where m and n are integers, comprising:

          means for preparing an array S[i] having  
array elements S[0] to S[m];

20           means for initializing all array  
elements of the array S[i] to zero and initializing an  
integer j to 1;

          means for renewing the array S[i] by  
adding 1 to each array element S[i] that is equal to  
25   an array element S[r] and that  $i \geq r$  if the array  
element S[r] is equal to an array element S[r-1] where  
r is an occurrence position of j-th atomic group of  
the second sequence in the first sequence;

          means for incrementing the integer j by  
30   1;

          means for repeatedly activating the  
renewing means and the incrementing means until the  
integer j exceeds n; and

          means for obtaining a longest common  
35   atomic group number between the first and the second  
sequences from a value of the array element S[m].

19.   An apparatus of claim 18, further comprising:

means for preparing an array data[k]  
having array elements data[0], data[1]...;

5 means for storing paired data (r, j) in  
an array element data [k] if the array element S[i] is  
changed by the renewing means where  $k = S[r]$ ;

means for linking the paired data (r, j)  
stored by the storing means to paired data (r', j') if  
 $r' < r$  and  $j' < j$  where the paired data (r', j') is  
one stored in an array element data [k-1]; and

- 10 means for obtaining a longest common  
subsequence between the first and the second sequences  
and occurrence positions of the longest common  
subsequence in the first and the second sequence by  
tracing the link formed by the linking means.

15 20. An apparatus of claim 18, further comprising  
means for evaluating homology between  
the first and the second sequences based on the  
longest common atomic group number and a value of one  
of m and n.

20 21. An apparatus for analyzing three-dimensional  
structures including a first structure expressed by  
three-dimensional coordinates of elements belonging to  
a first point set and a second structure expressed by  
three-dimensional coordinates of elements belonging to  
25 a second point set, comprising:

means for generating a combination of  
correspondence satisfying a restriction condition  
between the elements belonging to the first point set  
and the elements belonging to the second point set  
30 from among all candidates for the combination of  
correspondence; and

means for calculating a root mean square  
distance between the elements corresponding in the  
combination of correspondence generated by the  
generating means.

35 22. An apparatus for analyzing three-dimensional  
structures including a first structure expressed by

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three-dimensional coordinates of elements belonging to a first point set and a second structure expressed by three-dimensional coordinates of elements belonging to a second point set, comprising the steps of:

5 means for dividing the second point set into a plurality of subsets having a size that is determined by the size of the first point set;

means for generating a combination of correspondence satisfying a restriction condition  
10 between the elements belonging to the first point set and the elements belonging to each of the subsets of the second point set from among all candidates for the combination of correspondence; and

means for calculating a root mean square  
15 distance between the elements corresponding in the combination of correspondence generated by the generating means.

23. An apparatus for analyzing three-dimensional structures including a first structure expressed by  
20 three-dimensional coordinates of elements belonging to a first point set and a second structure expressed by three-dimensional coordinates of elements belonging to a second point set, comprising:

means for dividing the first point set  
25 and the second point set into first subsets and second subsets, respectively, according to a secondary structure exhibited by the three-dimensional coordinates of the elements of the first and the second point sets;

30 means for generating a combination of correspondence satisfying a first restriction condition between the first subsets and the second subsets from among candidates for the combination of correspondence;

35 means for determining an optimum correspondence between the elements belonging to each pair of subsets corresponding in the combination of

correspondence generated in the generating means, and means for calculating a root mean square distance between all of the elements corresponding in the optimum correspondence.

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項目	1990年	1991年	1992年	1993年	1994年	1995年	1996年	1997年	1998年	1999年	2000年	2001年	2002年	2003年	2004年	2005年	2006年	2007年	2008年	2009年	2010年	2011年	2012年	2013年	2014年	2015年	2016年	2017年	2018年	2019年	2020年	2021年	2022年	2023年	2024年	2025年	2026年	2027年	2028年	2029年	2030年	2031年	2032年	2033年	2034年	2035年	2036年	2037年	2038年	2039年	2040年	2041年	2042年	2043年	2044年	2045年	2046年	2047年	2048年	2049年	2050年	2051年	2052年	2053年	2054年	2055年	2056年	2057年	2058年	2059年	2060年	2061年	2062年	2063年	2064年	2065年	2066年	2067年	2068年	2069年	2070年	2071年	2072年	2073年	2074年	2075年	2076年	2077年	2078年	2079年	2080年	2081年	2082年	2083年	2084年	2085年	2086年	2087年	2088年	2089年	2090年	2091年	2092年	2093年	2094年	2095年	2096年	2097年	2098年	2099年	2100年																																																								
人口	120,000,000	121,000,000	122,000,000	123,000,000	124,000,000	125,000,000	126,000,000	127,000,000	128,000,000	129,000,000	130,000,000	131,000,000	132,000,000	133,000,000	134,000,000	135,000,000	136,000,000	137,000,000	138,000,000	139,000,000	140,000,000	141,000,000	142,000,000	143,000,000	144,000,000	145,000,000	146,000,000	147,000,000	148,000,000	149,000,000	150,000,000	151,000,000	152,000,000	153,000,000	154,000,000	155,000,000	156,000,000	157,000,000	158,000,000	159,000,000	160,000,000	161,000,000	162,000,000	163,000,000	164,000,000	165,000,000	166,000,000	167,000,000	168,000,000	169,000,000	170,000,000	171,000,000	172,000,000	173,000,000	174,000,000	175,000,000	176,000,000	177,000,000	178,000,000	179,000,000	180,000,000	181,000,000	182,000,000	183,000,000	184,000,000	185,000,000	186,000,000	187,000,000	188,000,000	189,000,000	190,000,000	191,000,000	192,000,000	193,000,000	194,000,000	195,000,000	196,000,000	197,000,000	198,000,000	199,000,000	200,000,000	201,000,000	202,000,000	203,000,000	204,000,000	205,000,000	206,000,000	207,000,000	208,000,000	209,000,000	210,000,000	211,000,000	212,000,000	213,000,000	214,000,000	215,000,000	216,000,000	217,000,000	218,000,000	219,000,000	220,000,000	221,000,000	222,000,000	223,000,000	224,000,000	225,000,000	226,000,000	227,000,000	228,000,000	229,000,000	230,000,000	231,000,000	232,000,000	233,000,000	234,000,000	235,000,000	236,000,000	237,000,000	238,000,000	239,000,000	240,000,000	241,000,000	242,000,000	243,000,000	244,000,000	245,000,000	246,000,000	247,000,000	248,000,000	249,000,000	250,000,000	251,000,000	252,000,000	253,000,000	254,000,000	255,000,000	256,000,000	257,000,000	258,000,000	259,000,000	260,000,000	261,000,000	262,000,000	263,000,000	264,000,000	265,000,000	266,000,000	267,000,000	268,000,000	269,000,000	270,000,000	271,000,000	272,000,000	273,000,000	274,000,000	275,000,000	276,000,000	277,000,000	278,000,000	279,000,000	280,000,000	281,000,000	282,000,000	283,000,000	284,000,000	285,000,000	286,000,000